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COST REDUCTION PROGRAMS

OF A

NATURAL GAS DISTRIBUTION FIRM

UNIVERSITY OF ALBERTA
FACULTY OF ARTS AND SCIENCE
(Department of Political Economy)

We, the undersigned, hereby certify that we have read this thesis entitled "Cost Reduction Programs Of A Natural Gas Distribution Firm", submitted by D. Howard Minchin in partial fulfilment of the requirements for the degree of Master of Arts.

University of Alberta,
Edmonton, Alberta.

THESIS
1956
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UNIVERSITY OF ALBERTA
FACULTY OF ARTS AND SCIENCE
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A Thesis

COST REDUCTION PROGRAMS

OF A

NATURAL GAS DISTRIBUTION FIRM

Submitted in partial fulfilment
of the
requirements for the degree of
Master of Arts

(Master's Program: six graduate courses
in addition to this thesis)

by

D. Howard Minchin

University of Alberta,
Edmonton, Alberta.

April 14, 1956.

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COST REDUCTION PROGRAMS OF A NATURAL GAS DISTRIBUTING FIRM

CHAPTER 1

A. Orientation

The economist is concerned primarily with the use of productive resources, and with the effects which particular procedures may have upon the economic use of these resources. This concept can be applied to the use of resources on an international or national scale and it can also be applied to the use of resources by an individual firm. This thesis is mainly concerned with the economic use of manpower, equipment and material in selected operations of a public utility.

Before a comprehensive cost-reduction study is undertaken of a selected operation, it must be established that the work will, in fact, result in a saving to the firm. This is accomplished by a preliminary survey to estimate the present and projected operating costs, the installation costs likely to be incurred, the cost of time of persons making the study, and the probable savings, both tangible and intangible. The savings in one year usually is expected to more than offset the costs arising out of the study.

B. Incentives To Reduce Costs Of Operation

A number of forces are at work inducing public utility management to strive for lower operating costs.

(a) Regulatory bodies generally recognize that, in the public interest, methods of regulation should include effective inducement to efficient management. 1/

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1/ Board of Public Utility Commissioners of the Province of Alberta.
Decision 1922

(b) Competition from alternative fuels or from other companies, for example in Edmonton where the natural gas franchise does not include the industrial consumers, is a genuine source of incentive to reduce operating costs.

(c) A small, almost unnoticeable trend to adverse public opinion will precipitate the quick action of a sensitive management. One or two "letters to the editor" pointing out the wasteful work habits of construction or maintenance crews usually results in remedial actions, precipitated, in part, by the privately owned public utility's fear of public ownership. The sensitivity of public utility management to public opinion is also demonstrated by the generally lower wage level than in other similar industries.

(d) The morale of most employees is directly related to their opportunity to do a reasonable day's work. The provision of that opportunity for each employee by a cost conscious management contributes to the efficiency of the company's operations by encouraging a higher daily work output per employee and at the same time induces good morale.

(e) Some franchises provide an option to purchase by the municipal authority. Such clauses induce reasonable operating costs.

(f) Rate hearings are crises in the lives of utilities which are to be avoided if possible because of their high cost and diversion of effort of key personnel. An effective way to avoid them is to reduce operating costs consistent with adequate service.

A cost reduction program is initiated by top management which directs a department working in a staff capacity to investigate situations of suspected high costs and to evolve remedial methods and procedures. Under conditions of rapid growth high cost situations can be expected to develop, perhaps more frequently than when growth is slower

and steadier. Situations of high or increasing costs may be detected by comparing the unit costs of the operation under review with comparable firms; or by discovering by analyzing internal records, operations of increasing unit costs over a number of years, taking into consideration increases in wage rates and the cost of materials.

C. Basic Philosophy Of A Cost Reduction Program

The objectives of a cost reduction program are positive. It is not a "speed-up" campaign aimed at getting employees to work at an unreasonable pace.

In the case of a study of records, the objective is to simplify and adjust the record keeping procedure in order to facilitate the actual work which they record and to reduce the cost of keeping the records. (See Chapter II)

In the case of a service department such as the stores or stock-room of a firm, the study aims to improve the service which the stock-room renders to other departments of the company in order to minimize the loss of productive man hours and at the same time reduce the operating cost of the service department when it is reasonable to do so. (See Chapter III)

In the case of crew operations, the objective is to distinguish between the factors affecting the efficiency of the crew which are beyond the control of the crew foreman and the factors which are within his control; to develop better job methods and supervisory procedures in order to promote operational economy and personnel morale. (See Chapter IV)

In the case of the participation of supervisors in the preparation of operating and maintenance budgets, it is a campaign to familiarize the line supervisors with thinking in terms of a full year's

activity and to develop the concept that they are responsible for the most advantageous employment of each member of their staff throughout the year. (See Chapter V)

The solution to a problem in cost reduction usually requires thinking beyond the established areas of past experience. The process involves these five fundamental steps: 2/

(a) Recognition of the problem and subsequently, a clear concept of the objectives of the study. The analyst must continually keep his objectives in mind, otherwise he will dissipate his energies in areas beyond the scope of the problem, or will never reach the heart of it.

(b) Gather the data pertinent to the problem. Again, the objectives must be kept clearly in mind in order to gather that data which is pertinent and to appreciate the significance of various parts of the data.

(c) Concentrate upon the data with the conscious mind and search for a solution.

(d) If the conscious mind is unable to cope with the problem, the subconscious mind may supply solutions during periods of mental relaxation. It is important to keep a notebook handy, because the solutions which the subconscious offers are elusive.

(e) Verify, in consultation with others concerned with the work, the solutions obtained and present them in a form which can and will be used by the line organization.

(f) The work of a staff organization in devising improvements will be fruitless if it is not clearly recognized that only the line

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2/ Randall, F.D. "Stimulate Your Executives to Think Creatively". Harvard Business Review. Vol.33, No.4 July-August 1955 pp.122-128

organization can put changes into effect. Thus the approach which is used in introducing the changes to the line organization is all-important. The study should be conducted from the beginning on a basis of participation with line people and they must feel that they have contributed to the changes and that any criticism of old procedures has been made by them. This technique of participation and opportunity for self-criticism is essential to a "will for improvement" in the line organization.

CHAPTER II

Revision of the Office Procedure of Preparing Service Applications and Service Orders to Facilitate the Actual Work which they Record and Reduce the Cost of Keeping the Records

A Definition:

A service application is a document which is completed by a representative of the Company and the applicant, arranging for a gas service to a house or other premises.

A service order is the form on which the installation of a service is authorized, recorded and priced.

B. The Problems & Objectives:

Our northern climate causes a peak of construction completions late in the fall. Applications for gas service coincide with or lead slightly this peak. Delays may develop between the completion of applications and the receipt of the service order by the installation crews. Delays may also develop between the actual installation and the customer billing.

The objectives of the study are to simplify and adjust the office routine of processing these two documents in order to maintain a relatively smooth flow of work to the installation crews, to minimize delays between the receipt of the application and the issue of the service order and to minimize delays in customer billing.

C Procedure:

The booklet "Instruments for the Effective Utilization of the Process Analysis Work Sheet in Office Work Simplifications Procedures" published by the Management Controls Division of Remington Rand, New York, recommends a method of analysis.

C Procedure (continued)

A careful procedure study of the existing routine is made in which the analyst begins with the beginning and follows the process through to the end. The flow of work to be analyzed begins when the customer requests the application clerk for gas service and supplies the information which the clerk enters in the application form. This is a hand posting operation. (See the Process Analysis Work Sheet, Illustration I). Then the clerk verifies the availability of gas by referring to maps of the distribution system. Because verification takes place, this action is classified as inspection. The listing of each step continues until the process is completely outlined and the totals computed as shown in Illustration I, Page 3.

There are occasions when it is difficult to classify definitely an action as to whether or not it is an operation, transportation, storage or an inspection. The following helps one to decide the proper classification:

<u>Classification</u>	<u>Predominate Result</u>
Operation	Produces or Accomplishes
Transportation	Moves
Storage	Keeps
Inspection	Verifies

After an accurate record of the steps in their exact sequence has been made on the Process Analysis Work Sheet a Flow Process Chart of the routine can be prepared. (See Illustration II) This chart graphically portrays the essential elements of the process and brings to light many previously unknown facts such as the unnecessarily complex credit approval procedure. Thus it is often the means of determining a better method of operation. In addition, in analyzing the original procedure, the analyst should determine why each operation, storage, transportation and inspection is done and decide if it is necessary. The preparation of the prospect

C Procedure (continued)

card and the handling of the service orders by the application clerks did not stand this test of being needed which led to their elimination.

After establishing that each remaining operation of the procedure is necessary, one should consider each operation in relation to the overall procedure to determine whether previous or succeeding processes may be changed to eliminate its necessity or whether it is possible to combine it with other operations. Control operations are vulnerable to this type of scrutiny, which in this study, led to the simplification of the registration of the applications.

The existing location of performing any operation should not be taken for granted because a questioning attitude may reveal duplication of work at different points, or lead to the discovery that work can be performed better or more economically at another point. The operations performed in the Distribution Office were transferred because they could be better performed in the Plant Records, thus avoiding an accumulation of "installed" service orders which resulted in billing delays. In determining the best location, the type of employee best suited to perform the operation and his qualifications and training must also be considered. Mentally active people should be assigned work requiring thought and judgment and not given routine assignments.

Careful checking of the method used to perform each operation may reveal excess motion. In the original procedure the curb box sheet was prepared after the service order was returned to the office whereas in the revised procedure it is typed as a copy of the service order.

There are four specific questions that serve as an acid test in determining the necessity of any operation.

C Procedure (continued)

Can it be eliminated?

Can it be combined?

Can the sequence be changed?

Can it be simplified?

In endeavoring to attain these objectives, one should guard against the over emphasis of eliminating, combining, changing or simplifying. Unrelated records should not be combined; operations should not be eliminated without carefully checking the effect of such action; a sequence should not be changed at one point if it creates difficulties at another place; simplification should not be carried to the extent that controls are impaired. In addition, operations requiring quick thinking and good judgment should not, if possible, be merged with those of a routine nature and excessive responsibility should not be concentrated at one point.

The foregoing analytical guides were used in developing the proposed procedure which was revised, improved and verified in meetings with others associated with the work. To get a picture of the changes that were made, it is probably advisable to break the process into several parts, the first being the progress of the application to the credit clerk. The steps in the original process are listed in lines one to four of Illustration I. Lines one to five of Illustration III describe the revised procedure which is very similar to the original.

Lines five to nineteen Illustration I, page one and lines six to fifteen Illustration III, page one, record the original and revised route of the applications to the Plant Records clerk. The number of operations were reduced from thirty-one to eighteen, mainly due to simplifying the credit approval procedure by eliminating the use of the credit card. It was used as control device to record the payment

of the customer's deposit and is replaced by the credit clerk noting on the application the details of prepayment, or if no prepayment, the initials of the credit manager. The revised procedure eliminated the delay caused by holding the application for checking against the duplicate counter slip which recorded that the customer had paid his deposit.

Also contributing to the simplification process is the routing of all applications directly to the typist who types the premises cards, which are subsequently used as a permanent record of meter installations, but in the revised procedure the premises cards replace the prospect card as a device to record applications held for credit or mains installation. This card is also used to record the service order number to indicate that the service order has been typed, a function previously filled by the prospect card. By routing all applications directly to the typist, the applications ready for installation are not delayed by being returned to the application clerk as occurred in the original procedure.

Line twenty, page one to line nine, page two, of Illustration I and line sixteen, page one to line four, page two of Illustration III record the original and revised procedure up to the delivery of the service order to the installation foreman. The number of operations were reduced from thirty-four to twenty-two by a number of changes. The application and service order are numbered by the Plant Records clerk rather than the application by the Sales Department clerk, and the service order by the Plant Records clerk. The service order, curb box sheet and copy in the revised procedure are typed in one operation, thus eliminating the filling-in of the curb box sheet by hand. The service order is routed directly to the installation foreman rather than returned to the application clerk. The service order and application

are not returned to the application clerk in the revised procedure because the statistics for which they were used were eliminated as unnecessary.

Line ten, page two to line nine, page three of Illustration I and line five, page two to line sixteen, page two of Illustration III record the balance of the procedure. The number of operations were reduced from forty-six to thirty-three, mainly due to by-passing the Distribution Office. In the revised procedure the flimsy or copy of the service order is destroyed after matching with the "installed" service order as compared with recording the date of installation on the flimsy, a duplication of work carried out by the Sales Department. The production controls kept jointly by the Distribution Office and the Plant Records, were eliminated because they were ineffective and replaced by the scheme outlined in Chapter IV. In the revised procedure the services installed sheet is completed in the Plant Records rather than the Distribution Office, because their personnel are more qualified for that type of work. By-passing the Distribution Office entirely, eliminated the chief source of delay in billing customers. Also, routing the "installed" service orders direct to the Sales Department, who initiate meter installations, eliminated a cause of delay in setting meters and required a monthly rather than a daily summary of services installed to be forwarded to the Sales Department by the Plant Records. In the original procedure the daily summary of services installed were used to initiate meter sets.

The adopted procedure was presented to those actually carrying out the routines in the Manual of Operations. This manual is an elaboration of the Flow Process Chart - Adopted Procedure Illustration IV. The right hand column records, chronologically, the operations, trans-

portations, storages, and inspections which are applied to the application and the service order. The left hand column records chronologically, in relation to the flow of the application and service order, other documents and control procedures which are essential to the routine.

The process of installing a service begins in the mind of the contractor who builds the structure to be served with gas and ends when the customer has been billed for the installation. This chapter deals with the record keeping portion of that process. The number of operations in the record keeping portion has been reduced from one hundred and fifteen to eighty by simplifying the credit approval, billing and other procedures, by eliminating duplication of subsidiary records in different offices, by reducing the number of times documents are handled and by eliminating unnecessary controls.

D Manual of Operation

Procedure For Service Application
And Service Order Routine

(Assuming necessity of signed application
and contract, and deposit)

Application prepared - at application
desk
- by salesmen
- by local agents

To include plan number only.
Details re mains location to be put on
here.

Availability of gas verified and house
number on plan to indicate application
received.

Also indicate on plan if application
out for signature.

Application not approved
because mains not installed,
to Sales Department Typist

Application approved for installation
to Credit Department Clerks via
customer.

M.&J. Counter Bill

M.&J. Counter Bill pre-
pared in duplicate where
necessary for amount of
deposit by credit depart-
ment clerk.

To cashier via credit clerk

Credit clerk to note on
application the details of
prepayment including
receipt number. Rubber
stamp supplied to provide
for amount of deposit and
receipt number.

Application to Credit Manager for
credit approval.

Premises Cards

Premises cards typed

To Sales record clerk

Premises cards red tabbed or blue tabbed to indicate held for credit or mains installation.

Cards filed geographically.

All applications to Sales Department Typist.

All applications to Sales record clerk

Inspects application re credit and mains installation

Applications held for credit or mains installation returned to application desk.

Applications approved for installation to Plant Records.

P.R. verifies plan number, location and size of main, and pressure. Also mark on curb box route number.

Also indicates location of I.P. and other gas mains and location of other utilities - telephone and electric.

Application and blank service order numbered. Cancelled numbers to be recorded and used.

Application returned to Sales Record Clerk.

Application Tally Record

File number and information in register. Signs application on behalf of company.

Service Order and Curb Box
Sheet with copy

Typed with information from
application.

NOTE: S.O.'s to be transported to and from North Yard in expandable envelope equipped with latch, via mail courier, twice daily.

The envelope to be dispatched even if there are no Service Orders to be transported.

Application, blank service order, and premises card to Sales Department Typist for typing service order and curb box sheet with copy.

Service Order and curb box sheet to be given same number as application.

Amount of prepayment to be typed on Service Order. Also types Service Order number on premises card to record service order typed.

Application, Premises Card, Service Order, Curb Box Sheet and copy to Junior Sales Clerk to check typing accuracy.

Application temporarily filed by number.

Premises Cards temporarily filed by number.

S.O. and copy to North Yard or to typist for mailing if out of town. Curb box sheets to Plant Records draughtsman who files by number.

Site examined to determine if ready for installation.

If site ready, Service Order allocated for installation, copy detached and filed.

If site not ready, Service Order and curb box copy to holding file.

Upon completion of installation, Service Order and copy matched. Copy destroyed. Service Order to Sales record clerk in special mailing envelope. Service installation date on application and initials on Service Order to indicate handled. Application permanently filed in installed file

Premises Card

Premises card pulled and forwarded to meter record clerk.

After Meter installation premises card to Junior sales clerk for meter entry and filed geographically.

Record of Services Installed

Statistics entered and filed.

Monthly Record of Service Installed

Compiled at end of each month and forwarded to Sales Department.

Monthly Record of Service
Pipe M to P

To Accounting Department
Stock Clerk

Curb Box Sheet

Completed by draughtsmen and filed in curb box route box

S.O. to Plant Records.

S.O. footages checked for accuracy.

S.O. priced.

S.O. to Accounting Department for invoicing. The prepaid amount to be shown and balance extended. Invoices mailed. Office copy of invoice to Accounts Receivable clerk.

Service Order to Plant Records' clerk for sorting into those which require plotting on curb box sheets and those which don't.

Service Order to draughtsmen for plotting.

S.O. to Plant Records' clerk who permanently files.

PROCESS ANALYSIS WORK SHEET

(Read instructions on other side before starting study)

ILLUSTRATION I

SUBJECT								DIVISION		CHART NO.		CHARTED BY			
Original procedure of Service Application and Service Order Office Routine								SECTION		PAGE NO. 1		D.H.M. DATE			
										OF 3 PAGES					
SUMMARY OF STEPS IN PROCESS															
	REFERENCE	HAND POSTING	TYPE OR MACHINE	OPERATIONS				TRANSPORTS	OTHER STEPS		TOTAL OF ALL STEPS	DISTANCE IN FEET	TIME		
				ROUTING ASSEMBLING COLLATING	FILING FINDING	OTHER	TOTAL		TEMPORARY	PERMANENT			INSPECTION	TOTAL	MIN.
PRESENT	5	24	1	6	6	9	51	24	26	4	10	64	115		
PROPOSED															
SAVINGS															

LINE NO.	STEPS IN PROCESS	OPERATIONS								OTHER STEPS			DISTANCE IN FEET	TIME	
		REF.	HAND POSTG.	TYPE OR MACH.	ROUT ASSEMB. COL.	FILE FIND	OTHER	TRANS	STORAGE TEMP.	STORAGE PMT.	INSP.	MIN.		SEC.	
1	Get relevant information from applicant and fill in application	REF	●	TM	SAC	FF	●	○	▽	▽	□				
2	Availability of gas verified	REF	HP	TM	SAC	FF	●	○	▽	▽	■				
3	Enters house numbers on plan sheet (Plan sheet marked out for signature if application taken out for signature)	REF	●	TM	SAC	FF	●	○	▽	▽	□				
4	Completed application taken by customer to clerk in Credit Department.	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
5	Credit Department clerk prepares counter slip and credit card from application. (Customer takes counter slip to make payment)	REF	●	TM	SAC	FF	●	○	▽	▽	□				
6	Credit card and application to credit supervisor and held pending arrival of paid counter slip.	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
7	Paid counter slip from cash register to credit supervisor and temporarily stored.	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
8	Credit cards and counter slips collated and credit slip dated to indicate payment. Also application initialled re credit OK	REF	●	TM	●	FF	●	○	▽	▽	■				
9	Credit card filed and stored	REF	HP	TM	SAC	●	○	○	▽	▽	□				
10	Counter slips taken to M & J posting clerk by credit supervisor or helper and temporarily stored	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
11	Service applications to application clerk from credit supervisor and temporarily stored	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
12	If application ^{not} O.K. for credit - held by application clerk	REF	HP	TM	SAC	FF	●	○	▽	▽	■				
13	If application not O.K. re extension - held by application clerk. If application O.K. ticked with green in upper R.H. corner	REF	●	TM	●	FF	●	○	▽	▽	■				
14	If application O.K. re credit and extension, to Sales Dept. clerk from application office	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
15	Sales Department clerk inspects for credit initials and extension approval.	REF	HP	TM	SAC	FF	●	○	▽	▽	■				
16	Prepares prospect card with address and name from application (Note: Sales Dept. clerk gets some applications without green tick)	REF	●	TM	SAC	FF	●	○	▽	▽	□				
17	Sent back to application office. These may not be complete re credit and/or extension in which cases prospect card red clipped and/or blue clipped)	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
18	File card	REF	HP	TM	SAC	●	○	○	▽	▽	□				
19	Application to Plant Records clerk	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
20	Plant Records clerk fills in curb box book number	REF	●	TM	SAC	FF	●	○	▽	▽	□				
21	Verifies or fills in plan number, pressure, location and size of main and other utilities. Temporarily stores	REF	●	TM	SAC	●	○	○	▽	▽	■				
22	Returns to Sales Department clerk and temporarily stored	REF	HP	TM	SAC	FF	●	○	▽	▽	□				
23	Application numbered	REF	●	TM	SAC	FF	●	○	▽	▽	□				
24	Number and information entered in register	REF	●	TM	SAC	FF	●	○	▽	▽	□				
25	Application passed to stereo for temporary storage	REF	HP	TM	SAC	FF	●	○	▽	▽	□				

CHECKED BY		DATE		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	
				2	10	-	2	3	1	11	13	-	6				
APPROVED BY		DATE		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	
				TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	

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PROCESS ANALYSIS WORK SHEET

(Read instructions on other side before starting study)

SUBJECT	DIVISION	CHART NO.	CHARTED BY
		PAGE NO. 2	D. H. M.
	SECTION	OF 3 PAGES	DATE

SUMMARY OF STEPS IN PROCESS												
	OPERATIONS							OTHER STEPS				TOTAL OF ALL STEPS
	REFERENCE	HAND POSTING	TYPE OR MACHINE	SORTING ASSEMBLING COLLATING	FILING FINDING	OTHER	TOTAL	TRANSPORTS	STORAGE TEMPORARY	PERMANENT	INSPECTION	
PRESENT												
PROPOSED												
SAVINGS												

LINE NO.	STEPS IN PROCESS	OPERATIONS							OTHER STEPS			DISTANCE IN FEET	TIME	
		REF.	HAND POSTO.	TYPE OR MACH.	SORT ASSEM. COL.	FILE FIND	OTHER	TRANS.	STORAGE TEMP.	PMT.	INSP.		MIN	SEC.
1	Service Order and one flimsy typed Also premises card typed		HP		SAC	FF	X		▽	▽	□			
2	Passed to clerk for checking with application Files premises card-temporary storage until service installed	REF	HP	TM	SAC	FF	X	●	▽	▽	■			
3	Staple Service Order and flimsy	REF	HP	TM	SAC	FF		○	▽	▽	□			
4	Application to Sales Dept. clerk. Also Service Order and copy Application filed-when service installed register ticked and Application dated re when service installed & application filed Permanent.	REF		TM	SAC		X	●	▽	▽	□			
5	Prospect card numbered to indicate S.O. typed and temporarily stored			TM	SAC	FF	X	●	▽	▽	□			
6	S.O. and flimsy to application office and temporarily stored	REF	HP	TM	SAC	FF	X	●	▽	▽	□			
7	S.O. counted and recorded to show comparison between S.O. issued and application received	REF		TM		FF	X	○	▽	▽	□			
8	S.O. s temporarily stored awaiting transport to installation foremen.	REF	HP	TM	SAC	FF	X	○	▽	▽	□			
9	Service Orders transported to installation foremen and temporarily stored while site examined.	REF	HP	TM	SAC	FF	X	●	▽	▽	□			
10	Examines to determine if ready for installation (Physically inspects the site)	REF	HP	TM	SAC	FF	X	○	▽	▽	□			
11	If ready S.O. allocated to sub-foremen, flimsy detached, labelled with sub-foreman's name and filed	REF		TM	SAC	FF		●	▽	▽	□			
12	If not ready S.O. and flimsy to holding file	REF	HP	TM			X	○	▽	▽	□			
13	Upon completion of installation S.O. and flimsy matched and forwarded to Distribution Office clerk and temporarily stored	REF	HP	TM		FF	X	●	▽	▽	□			
14	Date of installation on flimsy and stored permanently	REF		TM	SAC	FF	X	○	▽	▽	□			
15	S.O.'s arranged alphabetically by names of sub-foremen and listed on services installed sheet.	REF		TM		FF	X	○	▽	▽	□			
16	Services installed count by individual sub-foremen brought up-to-date.	REF		TM	SAC	FF	X	○	▽	▽	□			
17	S.O. footage checked against costing sheet footages, cost sheets to Distribution Office for partial costing	REF	HP	TM	SAC	FF	X	●	▽	▽	■			
18	Cost sheets partially costed	REF	HP	TM	SAC	FF		○	▽	▽	□			
19	Summary of services installed by months, brought up to date monthly and temporarily stored	REF		TM	SAC	FF	X	○	▽	▽	□			
20	S.O., service installed sheet, costing sheet forwarded to Plant Records and temporarily stored	REF	HP	TM	SAC	FF	X	●	▽	▽	□			
21	S.O. checked against services installed sheet-accuracy of detail re size and pressure	REF	HP	TM	SAC	FF	X	○	▽	▽	■			
22	Services installed sheets, accumulated to date-re size and pressure by Plant Records clerk and temporarily stored	REF		TM	SAC	FF	X	○	▽	▽	□			
23	S.O. stamped with official file number	REF	HP	TM	SAC	FF		○	▽	▽	□			
24	File number entered on record of services installed and other details completed re date and number installed, pressure & main to property pipe used	REF		TM	SAC	FF	X	○	▽	▽	□			
25	Letter to stock clerk monthly re main to property pipe used	REF												

CHECKED BY	DATE	ESTAL	TOTAL	ESTAL	TOTAL	ESTAL	TOTAL	ESTAL	TOTAL
APPROVED BY	DATE	11	1	4		1	1	1	1

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PROCESS ANALYSIS WORK SHEET

(Read instructions on other side before starting study)

SUBJECT		DIVISION	CHART NO.	CHARTED BY
		SECTION	PAGE NO. 3	D. H. M.
			OF 3 PAGES	DATE

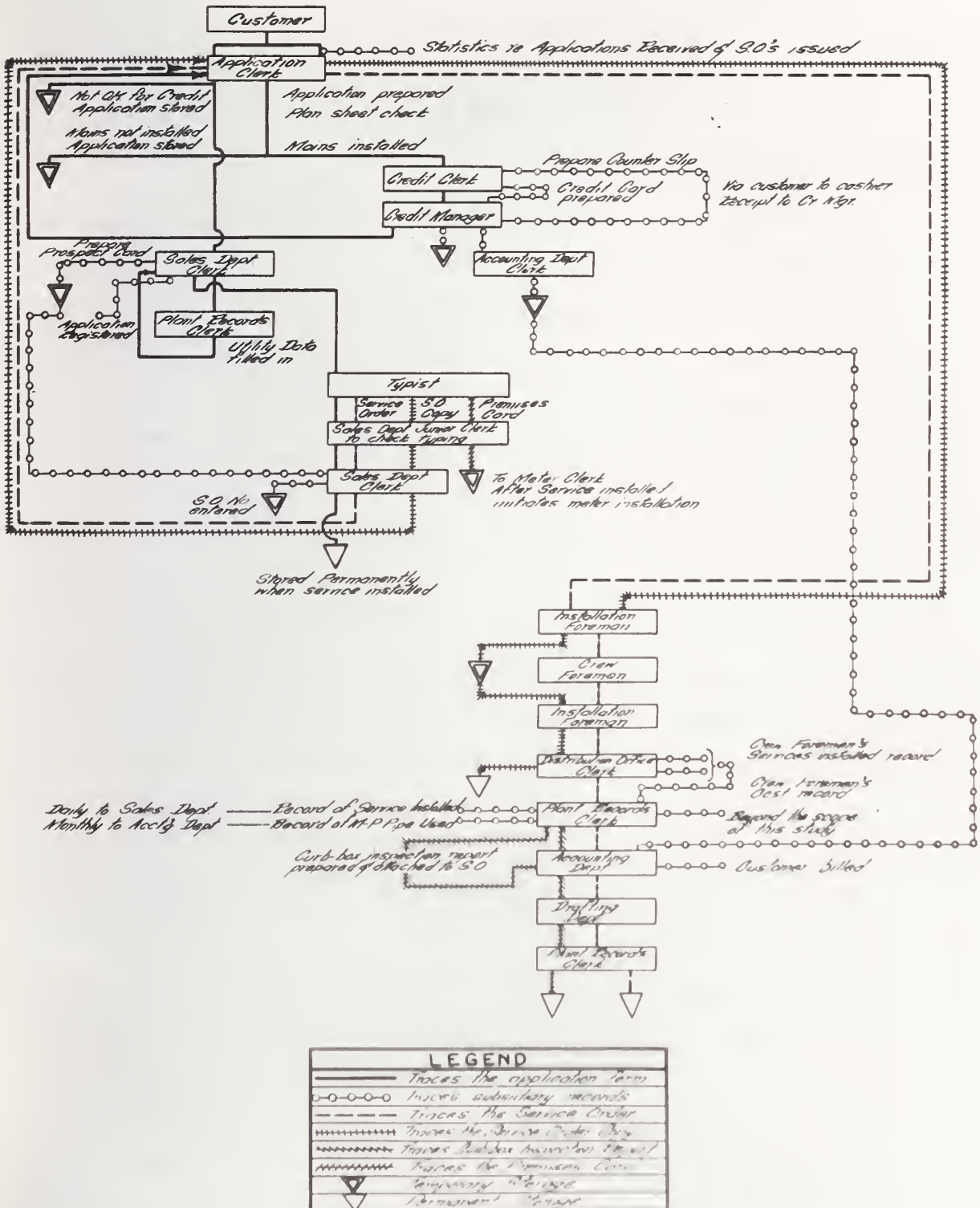
SUMMARY OF STEPS IN PROCESS															
	OPERATIONS						OTHER STEPS					TOTAL OF ALL STEPS	DISTANCE IN FEET	TIME	
	REFERENCE	HAND POSTING	TYPE OR MACHINE	SORTING ASSEMBLING COLLATING	FILING FINDING	OTHER	TOTAL	TRANSPORTS	STORAGE		INSPECTION			TOTAL	
									TEMPORARY	PERMANENT					
PRESENT															
PROPOSED															
SAVINGS															

LINE NO.	STEPS IN PROCESS	OPERATIONS						OTHER STEPS				DISTANCE IN FEET	TIME	
		REF.	HAND POSTG.	TYPE OR MACH.	STORAGE ASSEMBLING COLL.	FILE FIND	OTHER	TRANSP.	STORAGE TEMP.	STORAGE PMT.	INSPE.		MIN.	SEC.
1	Services installed report to Sales Dept. completed and forwarded daily to Sales Dept clerk.	REF	●	TM	SAC	FF	●	●	▽	▽	□			
2	Curb-box report prepared and attached to S.O.	●	●	TM	SAC	FF	●	●	▽	▽	□			
3	S.O. footage checked against sub-foreman's addition S.O. priced	REF	HP	TM	SAC	FF	●	●	▽	▽	■			
4	S.O. and curb-box report forwarded to Accounting Department for invoicing	REF	HP	TM	SAC	FF	●	●	▽	▽	□			
5	S.O. and curb-box report returned to Plant Records. Forwarded to draftsmen for plotting	REF	HP	TM	SAC	FF	●	●	▽	▽	□			
6	S.O. and curb-box report separated and curb box report into file box for routing into curb box book.	REF	HP	TM	SAC	FF	●	●	▽	▽	□			
7	S.O. returned to Plant Records clerk	REF	HP	TM	SAC	FF	●	●	▽	▽	□			
8	Remove staples and filed and permanently stored	REF	HP	TM	SAC	●	●	●	▽	▽	□			
9	At end of each month, monthly record of services installed, Disconnected & Reconnected, completed and forwarded to Sales Dept and originals stored.	REF	●	TM	SAC	FF	●	●	▽	▽	□			
10		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
11		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
12		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
13		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
14		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
15		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
16		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
17		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
18		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
19		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
20		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
21		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
22		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
23		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
24		REF	HP	TM	SAC	FF	●	●	▽	▽	□			
25		REF	HP	TM	SAC	FF	●	●	▽	▽	□			

CHECKED BY	DATE	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
APPROVED BY	DATE	1	3	—	—	1	4	4	1	2	1					1
FORM NO. 81-0051		COPYRIGHT 1949 REMINGTON RAND INC.		TOTAL UP ALL OPERATIONS		51		TOTAL UP ALL STORING POINTS RETURNED & INSPECTION		(4)		TOTAL UP ALL STEPS		115		

FLOW PROCESS CHART - ORIGINAL PROCEDURE

ILLUSTRATION II



PROCESS ANALYSIS WORK SHEET

ILLUSTRATION III

(Read Instructions on other side before starting study)

SUBJECT Adopted Procedure of Service Application and Service Order Office Routine	DIVISION	CHART NO.	CHARTED BY D.H.M. DATE
	SECTION	PAGE NO. 1	
	OF 2 PAGES		

SUMMARY OF STEPS IN PROCESS													TOTAL OF ALL STEPS	DISTANCE IN FEET	TIME	
	REFERENCE	HAND POSTING	TYPE OR MACHINE	ROUTING ASSEMBLING COLLATING	FILING FINDING	OTHER	TOTAL	TRANSPORTS	STORAGE		INSPECTION	TOTAL			MIN	SEC
									TEMPORARY	PERMANENT						
PRESENT	5	24	1	6	6	9	51	24	26	4	10	64	115			
PROPOSED	3	10	3	2	2	5	32	22	18	3	5	48	80			
SAVINGS																

LINE NO.	STEPS IN PROCESS	OPERATIONS							OTHER STEPS				DISTANCE IN FEET	TIME		
		REF.	HAND POSTING	TYPE OR MACH.	ROUTING ASSEMBLING COLL.	FILE FIND	OTHER	TRANS.	STORAGE		INSPECTION	MIN		SEC		
									TEMP.	PERM.						
1	Gets relevant information from applicant and fill in application	REF	●	TM	SAC	FF	●	●	▽	▽	□					
2	Availability of gas verified	REF	HP	TM	SAC	FF	●	●	▽	▽	■					
3	Enter house number on plan to indicate application received. Also indicated on plan if application out for signature	REF	●	TM	SAC	FF	●	●	▽	▽	□					
4	Application not approved because main not yet installed, to Sales Dept. typist and temporary storage.	REF	HP	TM	SAC	FF	●	●	▽	▽	□					
5	Application approved re main installed to Credit Department clerk via customer.	REF	HP	TM	SAC	FF	●	●	▽	▽	□					
6	Counter bill prepared in duplicate for amount of deposit	REF	●	TM	SAC	FF	●	●	▽	▽	□					
7	To cashier via credit clerk	REF	HP	TM	SAC	FF	●	●	▽	▽	□					
8	Credit clerk notes on contract details of prepayment including receipt number.	REF	●	TM	SAC	FF	●	●	▽	▽	□					
9	Application to Credit Manager for credit approval. Temporary storage	REF	HP	TM	SAC	FF	●	●	▽	▽	■					
10	Application to Sales Department typist Temporary storage	REF	HP	TM	SAC	FF	●	●	▽	▽	□					
11	Premises cards typed and passed to Sales Department clerk, along with applications	REF	HP	●	SAC	FF	●	●	▽	▽	□					
12	Premises cards red or blue tabbed to indicate held for credit or mains installation	●	HP	TM	SAC	FF	●	●	▽	▽	□					
13	Premises cards filed geographically and temporarily stored	REF	HP	TM	SAC	●	●	●	▽	▽	□					
14	Applications held for credit or mains installation returned to application office and temporarily stored	REF	HP	TM	SAC	FF	●	●	▽	▽	□					
15	Applications approved for installation to Plant Records Temporary storage	REF	HP	TM	SAC	FF	●	●	▽	▽	□					
16	Plan number and location of main verified. Size and pressure of main, curb box route number, location of other gas mains and utilities supplied.	●	●	TM	SAC	FF	●	●	▽	▽	■					
17		REF	HP	TM	SAC	FF	●	●	▽	▽	□					
18	Applications and blank service orders numbered. (Cancelled numbers to be recorded and used)	REF	HP	TM	SAC	FF	●	●	▽	▽	□					
19	Applications and blank service orders to Sales Department clerk Temporary storage	REF	HP	TM	SAC	FF	●	●	▽	▽	□					
20	Applications registered in Tally Record and applications signed on behalf of company	REF	●	TM	SAC	FF	●	●	▽	▽	□					
21	Relevant premises cards drawn from temporary storage	REF	HP	TM	SAC	●	●	●	▽	▽	□					
22	Application, numbered service order and premises card to typist.	REF	HP	FF	SAC	FF	●	●	▽	▽	□					
23	Service order, curb-box sheet and copy typed with information from application including amount of prepayment on S.O.	●	HP	●	SAC	FF	●	●	▽	▽	□					
24	Service order number typed on premises card	REF	HP	●	SAC	FF	●	●	▽	▽	□					
25	Application, service order, curb-box sheet and copy, and premises card to Sales Dept., junior clerk to check typing accuracy	REF	HP	TM	SAC	FF	●	●	▽	▽	■					
CHECKED BY		DATE		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
APPROVED BY		DATE		3	6	3	2	2	11	7	-	6				
TOTAL OF ALL OPERATIONS				TOTAL OF ALL TRANS.				TOTAL OF ALL STORAGE				TOTAL OF ALL INSPECTION				

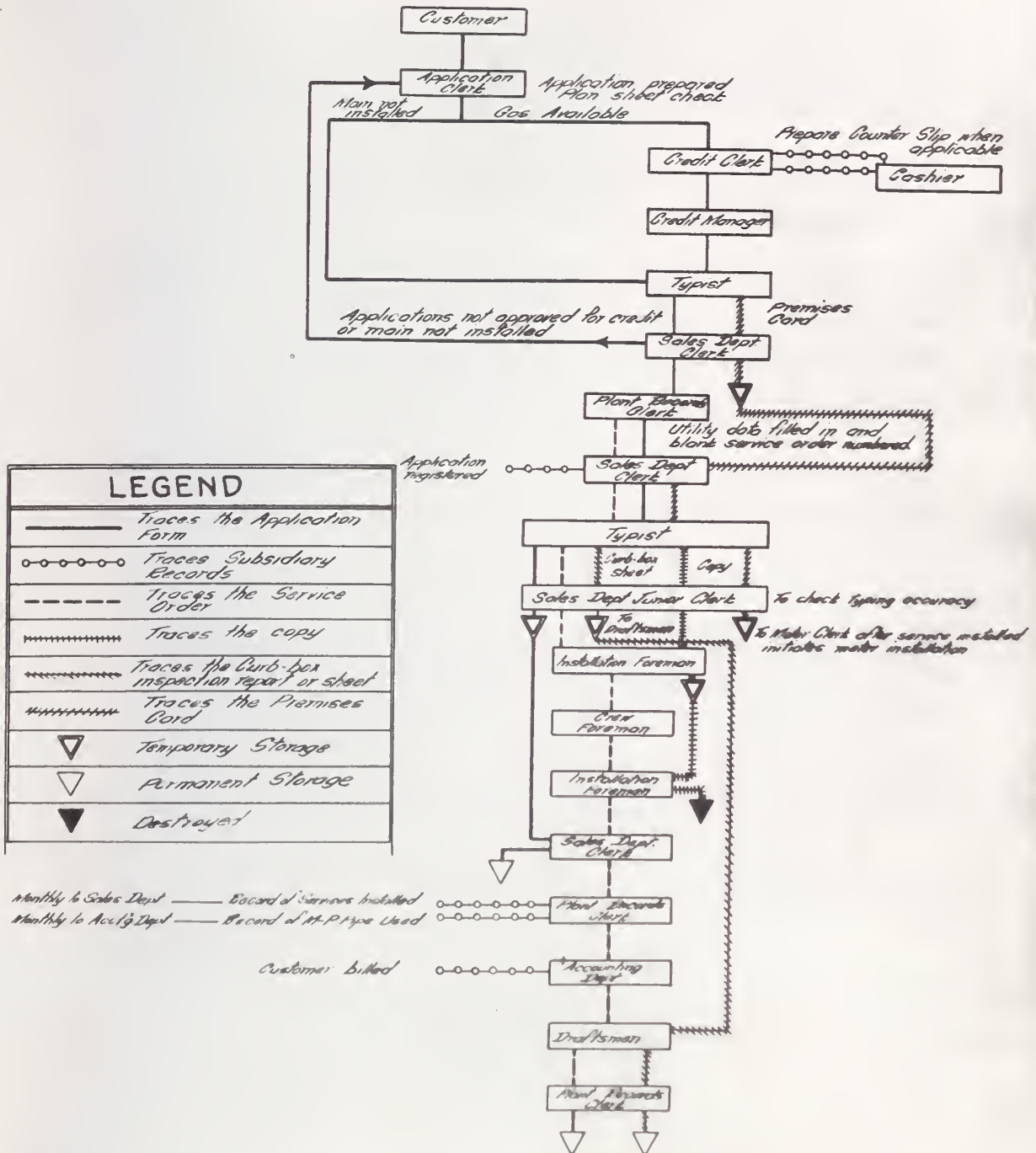
PROCESS ANALYSIS WORK SHEET

(Read instructions on other side before starting study)

SUBJECT Application Procedure of Service Application and Service Order Office Routine						DIVISION SECTION		CHART NO. PAGE NO. 2 OF 2 PAGES		CHARTED BY D.H.M. DATE			
SUMMARY OF STEPS IN PROCESS													
OPERATIONS													
	REFERENCE	HAND POSTING	TYPE OR MACHINE	ROUTING ASSEMBLING COLLATING	FILING FINDING	OTHER	TOTAL	OTHER STEPS					
								TRANSPORTS	STORAGE TEMPORARY PERMANENT	INSPECTION	TOTAL		
PRESENT													
PROPOSED													
SAVINGS													
STEPS IN PROCESS													
LINE NO.							OPERATIONS		OTHER STEPS		DISTANCE	TIME	
	REF.	HAND POSTO.	TYPE OR MACH.	ROUT ASSEM. COL.	FILE FIND	OTHER	TRANS	STORAGE TEMP. PMT.	INSP.	IN FEET	MIN	SEC.	
1	Applications filed by number and temporarily stored	REF	HP	TM	SAC								
2	Premises card filed by number and temporarily stored	REF	HP	TM	SAC								
3	Curb-box sheets to Plant Records draftsman who files by number and temporarily stores	REF	HP	TM	SAC								
4	Service orders and curb-box sheet copies to installation foreman and temporarily stored while site examined.	REF	HP	TM	SAC	FF							
5	If site ready, service order allocated for installation, copy labelled with service crew foreman's name and temporarily stored	REF		TM	SAC	FF							
6	If site not ready, service order and copy filed and temporarily stored.	REF	HP	TM									
7	Upon completion of installation service order and copy matched (This assures no S.O.'s lost while with crews) Copy destroyed	REF	HP	TM		FF							
8	Service orders to Sales Department clerk and temporary storage	REF	HP	TM	SAC	FF							
9	Corresponding applications pulled, installation date entered and permanently filed.	REF		TM	SAC								
10	Corresponding premises cards pulled and sent to meter record clerk which initiates meter installation.	REF	HP	TM	SAC								
11	Service order to Plant Records and temporarily stored	REF	HP	TM	SAC	FF							
12	Service Order numbers posted to Record of Services installed, accumulated at end of month and forwarded to Sales Department	REF		TM	SAC	FF							
13	Service Order footage checked for accuracy and record of main to property pipe used accumulated and forwarded to Accounting Department clerk monthly	REF		TM	SAC	FF							
14	Service Order priced and forwarded to Accounting Department for billing.	REF	HP	TM	SAC	FF							
15	Service Orders to draftsmen for completion of curb-box sheets.	REF	HP	TM	SAC								
16	Service orders and curb-box sheets to Plant Records clerks for permanent filing.	REF	HP	TM	SAC	FF							
17		REF	HP	TM	SAC	FF							
18		REF	HP	TM	SAC	FF							
19		REF	HP	TM	SAC	FF							
20		REF	HP	TM	SAC	FF							
21		REF	HP	TM	SAC	FF							
22		REF	HP	TM	SAC	FF							
23		REF	HP	TM	SAC	FF							
24		REF	HP	TM	SAC	FF							
25		REF	HP	TM	SAC	FF							
CHECKED BY		DATE		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	
APPROVED BY		DATE		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	
				4		2		7		11		3	
				TOTAL UP ALL OPERATIONS		32		TOTAL UP ALL TRANS		40		TOTAL UP ALL STEPS	

FLOW PROCESS CHART— ADOPTED PROCEDURE

ILLUSTRATION IV



INSTRUCTIONS

The following instructions will help you prepare the Process Analysis Work Sheet:

I STEPS IN PROCESS - In these spaces describe briefly but clearly each step in the process. List in order of occurrence, show distance and time for important steps. Limit each space to one step or combined step only. A common example of a combined step is an operation and inspection that are performed simultaneously.

II ELEMENTS OF WORK - All elements of work fall into the following five general classifications:

A. **Operation** - "An operation occurs when an object is intentionally changed in any of its physical or chemical characteristics, is assembled with or disassembled from another object, or is arranged or prepared for another operation, transportation, inspection or storage. An operation also occurs when information is given or received or when planning or calculating takes place." A breakdown of office operations indicate the majority of them pertain to:

- (REF) 1. **Reference** as an operation is the directing of one's attention to a record or some data source to secure information. An excellent example of this is a clerk referring to a cross index to secure an account number. Note the distinction between this type of reference which is an operation only and a reference that also involves inspection. (Sect. II E).
- (HP) 2. **Hand Posting** includes any type of manual writing, ranging from the preparation of a lengthy document to initialing or signing a paper.
- (TM) 3. **Typewriter or Machine Operation** includes any mechanized office operation such as operating a typewriter, adding, calculating or billing machines, tabulating equipment and duplicating units. Photographic reproduction operations are usually placed in this classification.
- (SAC) 4. **Sorting** includes sorting and assembling or collating of papers. Sorting can result in storage, usually temporary; e. g., papers in a sorting device or mailing rack. When this occurs, code both the operation of sorting, SAC, and the symbol for storage, temporary or permanent. These should be shown as separate steps, but can be combined in one to save space.
- (FF) 5. **Filing or Finding** are related office operations. Finding is an operation only, whereas filing involves storage. Be careful to make this distinction clear by coding both the operations of Filing, FF, and the proper storage symbol, temporary or permanent. These should be shown as separate steps, but can be combined in one to save space.
- (X) 6. **All other operations** are coded as X in the sixth column.

B. **Transportation** - "Transportation occurs when an object is moved from one place to another except when such movements are caused by the process or by the operator at the work station during an operation or an inspection."

C. **Temporary Storage** occurs when an object is kept pending further processing.

D. **Permanent Storage** occurs when an object is kept at a point set aside as the final storage place for the object. **Note:** If record is discarded or destroyed, make this triangle a solid black.

E. **Inspection** - "An inspection occurs when an object is examined for identification, verified for quality or quantity, or measured in any of its characteristics." This includes examining a document for its completeness, accuracy, etc. Inspection as a reference is the checking of information received from one source against that secured from another source, i. e., verification. Example, clerk checking a physical count of stock report against the office stock record. This is a combined operation of reference and inspection and the symbols for Reference and Inspection should always be coded on the same line. Note the distinction between this type of reference and an operation reference. (Sect. II A. 1).

III DETERMINING THE PROPER SYMBOL - It is sometimes difficult to classify definitely a situation as an operation, transportation, storage or an inspection. This is particularly true in the case of operations and inspections that are combined, e. g., reference as an operation and as an inspection (Sect. II E). The following will enable one to decide as to the proper classification: An operation always produces or accomplishes something; Transportation results in movement; Storage means keeping and Inspection always verifies.

IV REMEMBER THESE QUESTIONS:

- | | | |
|---------------------------------|--------------------------------|----------------------------------|
| 1. Why should the work be done? | 3. How is the work to be done? | 5. Where is the work to be done? |
| 2. What is to be done? | 4. Who is to do the work? | 6. When is the work to be done? |

ALWAYS ASK YOURSELF:

- | | |
|---------------------|---------------------------|
| 1. Can I eliminate? | 3. Can I change sequence? |
| 2. Can I combine? | 4. Can I simplify? |

*This space for notes or sketches
(Scale 10 spaces to the inch)*

CHAPTER III

Preliminary Study Of The Central Stores And Proposed Procedure Of An Additional Study To Improve Methods Of Materials Handling

A The Preliminary Study

After observing the existing methods of operation of the stores, and that the problem of space was not acute, it was decided that the improvement program should be divided into two parts and that the second part of the study should not be undertaken until the objectives of the first have been achieved. The underlying objectives of the preliminary study is to develop a pattern of operation and a way of thinking by the stores staff which would create the climate necessary for the effective implementation of better materials handling procedures. The other objectives of the preliminary study foster the underlying objective. They are to improve the service to other departments of the company in order to reduce the loss of productive man hours of other departments, and to develop work patterns in the stores which are prerequisite to the introduction of a comprehensive materials handling plan.

The procedure of issuing material and gasoline and oil usually resulted in bottlenecks between eight A.M. and nine A.M. most working days of the year. During the busy construction season, bottlenecks also developed between one and two P.M. and between four and five P.M. These bottlenecks can be avoided by:

- a) Off-hours loading of trucks, including noon hour loading
- b) Off-hours servicing of trucks with gas and oil

In the case of off-hours loading, each truck and/or crew is equipped with a supply of stock issue and return slips and a canvass bag to contain small items. Requisitions covering the next order are submitted to the stores by five P.M. or twelve noon, together with returned

material and return slips. The method of submitting requisitions and returns varies. Meter setters, customer service men, operation, maintenance and alteration crews, since they normally return to the central yard at five P.M. deliver their own requisitions and returns. The foremen of installation crews forward their requisitions and returns via their drivers.

Vehicles are serviced with gas and oil during the course of the evening shift upon completion at five P.M. of the existing gas and oil issue slips.

Off-hour loading and servicing of trucks with gasoline and oil requires that some of the stores personnel work staggered hours. Because the need of other departments for service varies throughout the year, the number of personnel on shift and the shift hours vary with demand.

The stores personnel working after five P.M. handle the five P.M. requisitions for materials, the returns and vehicle service requests. Large items are loaded on the trucks, small items in the canvas bags and pipe on the carriers. The driver or foreman checks the material which has been loaded onto his truck with the stock issue slip.

No extension of records are required. Stock issue and return slips are used as in the past, requests for tools are filled upon return of the used one, and vehicles are serviced in the evening upon completion at five P.M. of the existing gas and oil issue slips.

The second objective of the preliminary study is to develop work patterns which are a prerequisite to the introduction of a comprehensive materials handling plan. The physical layout of the central stores provides four outlets - the west end, the east end, the tool room, and

the yard. Two men are assigned to duties within each of these sections; additional staff is provided during the construction season. Under the policy that prompt service takes priority over any other stores activity, it is advisable that all members of the staff be trained for and work on counter and yard service when and where required. Excessive specialization impairs the mobility of personnel and is detrimental to prompt service.

A limited program of palletizing is also instrumental in advancing the second objective and at the same time conserves space and provides an easier and speedier way of handling material.

The act of receiving and storing goods does not pose the same problem as issuing in that service to other departments of the Company is indirectly rather than directly involved. A large proportion of the goods arrive during the off-peak season and most of the man hours used in receiving and storing do not fall into the "now" category and thus storing can be done within reason at the convenience of the stores staff.

Under the existing layout, one out-building and two locations in the main warehouse are available for palletizing material. In these areas rolls of asbestos felt, bags of cement, cases of wiping rags and welding rod, standard packages of dresser couplings, service cocks, nipples and elbows are stored on frame pallets. Cases of house regulators are palletized with pieces of timber four inches square by eighteen inches. Service tees, risers and spindles, which are pre-fabricated in the shop adjoining the warehouse are handled and stored in palletainers.

The following examples illustrate the reduction in number of handlings when palletizing procedures are used.

(1) Handling of forty-eight rolls of asbestos paper used by the enamelling yard.

Present Procedure:

<u>Description of Action</u>	<u>Number of Handlings</u>
Receiving and Storing:	
Unload from box car onto truck	48
Transport to storage shed	1
Unload from truck and pile	48
Issuing:	
Loaded onto cart for use in enamel yard	48
Transport to enamel yard	1
Unloaded from cart and piled in enamel shed	48
Each roll handled when put into use	<u>48</u>
	242

Procedure Using Frame Pallet:

<u>Description of Action</u>	<u>Number of Handlings</u>
Receiving and Storing:	
Unload from box car onto pallet on truck	
48 rolls and one pallet	49
Transport to storage shed	1
Unload pallet of 48 rolls with fork lift truck	
and palletize	1
Issuing:	
Load pallet of 48 rolls onto fork lift	1
Transport to enamel yard	1
Deposit pallet of 48 rolls in enamel shed	1
Each roll handled when put into use	48
Return pallet	<u>1</u>
	103

Savings in number of handlings $242 - 103 =$ 139

Percentage reduction in number of handlings is 58%

(2) Handling Three Hundred Prefabricated Risers.

Present Procedure:

<u>Description</u>	<u>Number of Handlings</u>
Receiving and Storing:	
Ordinary container to tester of prefabricated risers	1
Risers loaded into container and count recorded	300
Loaded container transported to storage bins	1
Risers unloaded into storage bins	300
Issuing:	
Load risers into ordinary container	300
Transport loaded container to issue area	1
Risers issued as required	<u>300</u>
	1203

Procedure Using Palletizers:

<u>Description</u>	<u>Number of Handlings</u>
Receiving and Storing:	
Palletainer to tester of prefabricated risers	1
Risers loaded into palletainer and count recorded	300
Loaded palletainer to storage area via fork lift truck	1
Loaded palletainer stored	1
Issuing:	
Loaded palletainer from storage to issue area via fork lift truck	1
Risers issued as required	<u>300</u>
	604
Savings in number of handlings $1203 - 604$	599
Percentage reductions in number of handlings	50%

B Proposed Procedure Of An Additional Study to Improve Materials Handling At The Central Warehouse /1

When the problem of space at the central warehouse has become acute and when the objectives of the preliminary study have been realized, the need for a more comprehensive study, and justification for it in terms of cost, will exist. The cost of the study itself is usually limited to the time of the personnel involved and probably would not exceed fifteen hundred dollars. Adoption of the recommendations would depend upon whether the cost of the investment in the suggested equipment, alterations and/or additions to the building were less than the cost of the alternative investment. Also to be taken into consideration is any reduction in the cost of operating the stores and any additional saving of time of the staffs of other departments arising out of better service.

The analyst must have the objectives of the study clearly in mind. They are to conserve storage space and to facilitate rapid filling of orders by eliminating handling operations wherever possible and minimizing travel distances. He must also keep in mind maximum safety for personnel and minimum damage to material.

Along with the flow process charts of the existing procedure a body of data should be compiled. This data is required in preparing the flow process charts of the proposed procedure. It consists of the classification of materials by weight, bulk, inflammability, type of storage required, type of package, when storage required and care required in handling. The data required also consists of the rate of turnover of specific materials, the layout drawings of the stores, including ceiling heights, carrying load of floors, the existence of ramps and obstructions,

- - - - -

1/ Shubin and Madeheim, Plant Layout. Prentice-Hall Inc., New York

the distances materials are moved to storage and to outlets, the available routes of movement whether by floor or overhead, the available handling equipment and existing methods of handling.

With this body of data, with the flow process charts of the existing procedure and with the objectives of the study firmly in mind, prepare proposed flow process charts. In creating the proposed flow process charts the analyst is guided by these secondary objectives. Establish inlets, storage areas and outlets, routes of travel and the best means of transport - ground or overhead. Inlets, storage areas and outlets should be arranged for least handling, shortest transportation distances, and be best suited to the classification of the material and the rate of turnover. In the case of materials with a high rate of turnover provide storage space near their outlet which is reasonable to meet short term demand and provide storage space at a more remote location for additional supplies. To reduce the probability of injury to personnel and damage to materials, mechanize to reduce strenuous handling.

The flow process charts should be accompanied by recommendations dealing with the best suited containers and their best loads, the handling equipment which is best suited to the containers and the space available for operation. Examples of containers are frame pallets, pallet racks, palletainers, bins, standard packages and bags. Containers should be selected which will conserve floor space, provide flexibility and accessibility, and can be issued as a unit whenever feasible such as a standard package or a loaded pallet. In selecting handling equipment consideration should also be given to flexibility and safety, suitability for long run needs, purchase price and operating and maintenance costs. Examples of equipment are wheelbarrows, hand trucks, power or hand cranes and fork lift trucks.

During the study frequent informal consultations should be held with the people associated with the work so that they will feel a part of the improvement program and so that they may criticize existing or proposed procedures and make suggestions for improvement. If this is done the proposed procedures will be acceptable to them, which is essential, because successful implementation is related to their acceptance.

At a formal meeting of the people concerned, the proposed procedure is reviewed, improved and verified. This meeting deals with a mass of detail which is essential to assure the workability of the plan and which is listed at the end of this Chapter. The chairman should assure that all members of the review committee have the functions of the stores clearly in mind and that they are in accord with the objectives of the program.

The major items dealt with during the course of the meeting are the verification of the flow charts, the completeness of the classification of material and the validity of the rates of turnover, the suitability of storage and handling equipment recommended, the use of space, provisions for security, and stock levels to be kept on hand.

The storing and handling of material is a horizontal rather than a vertical activity that cuts across departmental lines to become a company-wide function requiring an inter-departmental approach and co-operation. Thus storing and handling is important because of its scope because it involves a substantial operating expense, because good techniques enable the stores department to provide better service to the company, and because good practices in materials handling and storing lead to safer operation.

Check Points To Be Used By The Review Committee In Reviewing,
Improving and Verifying the Proposed Procedure.

The following check points are from a paper by P. T. Hughes,
Chairman of the Purchasing and Stores Committee of the American Gas Ass'n.
Warehouse Operations:

Warehouse Operations

1) Be sure that all members of the review committee have the functions of the stores clearly in mind and that they are in accord with the objectives of the program.

2) Verify that the flow chart covers every function for which the stores are responsible.

3) Examine the classification and rate of turnover of material, which has been prepared, for completeness and validity.

4) Is the material handling equipment to be used flexible and adequate?

5) Is the storage equipment - palletainers, pallets, bins, etc. and their proposed locations properly adjusted to:

- The weight and shape of material to be stored?
- The ability of the material to support weight without being crushed?
- The diversity of the material to be stored?
- The necessity for and importance of varying degrees of accessibility?

This involves consideration of the number of adjacent or supported pallets to be moved in order to get at the pallet desired and the labor savings to accrue from increased accessibility.

- The best use of horizontal and vertical space?
- The aisle space required?
- The floor loading capacity, column locations, overhead clearances, and storage area shape and size?

6) Is heated or cold storage space as required provided for materials that must be placed under cover?

7) Is storage space for inflammable items safe?

8) Are racks provided for drums and is location appropriate?

9) Is adequate space provided for accumulation of material for specific jobs?

10) Are special facilities adequate for storing tools, ladders, and other awkward items?

- 11) Is parking space provided for lift trucks, hand trucks, and other material handling equipment?
- 12) Are emergency materials segregated and identified?
- 13) Is adequate space provided for warehouse supervisory and clerical personnel and will paperwork be affected by strong draughts?
- 14) Is adequate aisle space provided?
- 15) Is control of traffic of other personnel provided for?
- 16) Are receiving and shipping docks and areas large enough?
- 17) Is security provided for hard to control items?
- 18) Are the handling techniques suggested suited to the location, the material and the container?
- 19) Does the flow process chart provide a practical system for dispatching materials to pre-designated locations and for locating materials when required?
- 20) Are the stock levels suggested reasonable taking into consideration availability, rate of turnover and seasonal peaks?
- 21) Does the plan limit accessibility to critical items?
- 22) Does the placement of material lend itself to good inventory technique?
- 23) Does the warehouse operation lend itself to good housekeeping?
- 24) Can night loading be effectively carried out?
- 25) Can trucks be advantageously located for night loading?
- 26) Is space provided for making up standard packages?
- 27) Is space provided for miscellaneous storage?
- 28) Is emergency equipment accessible?
- 29) Will cross traffic in the warehouse become a problem?
- 30) Will the spaces not occupied by pallets be suitable for palletization at a later date?
- 31) Can the tool room be expanded later if required?
- 32) Does the layout of the warehouse permit effective supervision of personnel?
- 33) Can issuing counters be expanded in the future?

Warehouse Equipment

- 1) Are the suggested racks or shelving standard and interchangeable?
- 2) Are the computations of floor and shelf tonnages accurate?
- 3) Is the detailed plan of all material to be stored complete?
- 4) Are all bins provided with label holders?
- 5) Is the material handling equipment suggested the best compromise from the points of view of utilization and cost?
- 6) Is the fork lift truck suitable regarding required fork lift and permissible mast height?
- 7) Are the pallet-racks selected properly designed considering ease of installation, need for adjustability, weight to be carried, pallet sizes, tray spans and height?
- 8) Are stacking containers used wherever possible?
- 9) Is shelving higher than seven feet?
- 10) Are fire hoses and equipment and first-aid equipment properly placed?
- 11) Are there any warehouse or yard facilities lower than the maximum mast height plus load on the fork lift truck?
- 12) Are the aisles and shelves adequately lit and the electric outlets accessible?

CHAPTER IV

To Reduce The Cost Of Labor Installing Services

A Scope Of The Study

A service line is the pipeline which carries gas from the main in a street or lane into a building. The total cost of installation is made up of pipe and other materials, labor, including supervision and clerical, transportation, depreciation on equipment, and miscellaneous supplies and expenses. This study is concerned with the reduction of the cost of labor installing services.

B Factors Which Influence The Labor Cost of Installing Services

A period of observation revealed there are two major types of factors which influence the labor cost of installing services.

- 1) Factors which are beyond the control of the service crew foreman.
- 2) Factors which are within the control of the service crew foreman.

1) Factors Which Are Beyond The Control Of The Service Crew Foreman

a) The nature of the ground in which the services are installed. In some areas digging is difficult, whereas in others digging is comparatively easy. Ditches which are ditcher dug reduce the significance of this factor, but some significance remains because bell holes must be dug by hand. The time required to dig a bell hole varies from one and a quarter man hours to two and a quarter man hours.

b) The frequency and length of moves. Crews working on scattered services move as frequently as three times per day. Moves result in a loss of productive time because equipment must be packed and unpacked and travelling time between installations is involved. The

longer the move, the greater the loss of productive time, and the larger the crew, the greater the labor cost of the move. In addition, the higher the frequency of the moves, the greater the probability of losing time awaiting transportation.

c) Occasionally crews arrive at the site of a service installation to find the route of the service line obstructed by a mound of dirt or other debris. Loss of time results from removing the debris, making another move or awaiting further instructions.

d) Some crews doing scattered services are larger than necessary, resulting in excessive labor cost.

2) Factors Which Are Within The Control Of The Service Crew

a) Some crews occasionally are delayed due to a shortage of supplies at the site of the job. Service trucks visit crews two or three times daily, yet shortages occur.

b) Some foremen tolerate ineffective men on their crews which adversely affects the output of other workers.

c) Work output is reduced by tools which do not operate efficiently.

d) The attitude, organizing ability and activity of the crew foreman is significant. Some guide the work effectively but are not very active, some of the foremen are active but do not guide effectively, some are neither active nor guide effectively, and the remainder both guide effectively and are themselves active. The latter group usually have the lowest unit costs.

C Procedures Which Have Been Developed To Reduce The Labor Cost Of Installing Services

1) The service order routine was revised to smooth the flow of service orders to the installation supervisor which enable him to reduce moves. (See Chapter II)

2) Prior to issuing the service orders to the installation crews the following precautions are taken:

a) The site is inspected to be sure it is ready and the service entry is marked on the building.

b) The time of issue of the service orders to the crew foremen is adjusted to permit installation in a series, rather than scattered installations, whenever possible. If other installations will be made nearby and will not require a move, which are not ready now, but will be in the near future, it is reasonable to hold back service orders until a group is accumulated which will permit installation in a series.

c) It is determined whether the service can be ditcher dug. The labor and equipment cost of a ditcher dug service is in the order of 20% less than a hand dug service.

d) In the case of an abnormal installation, information is provided which will enable the crew foreman to obtain the necessary tools and materials prior to moving to the job.

3) A study was undertaken to determine the most efficient size and procedure for a crew doing scattered hand dug services (See Illustration I)

The essential activities that must be performed were determined, and coincidentally, the time required to accomplish each activity. Several activity charts were taken of crews performing an installation. These charts revealed excessive standby time due to more men than necessary and faulty sequence of performing the various elements of the job. Illustration I was developed to record the standard times for job elements, to demonstrate the economic crew size for hand dug scattered services and to point out the most efficient sequence of performing the various elements of the installation.

4) A report to be completed daily by the crew foreman, was developed to record the completed installations, the actual time spent on the installation (productive hours), and the actual time spent moving or waiting (non-productive hours). (See Illustration II)

Using the standard times recorded on the activity chart, Illustration I, a procedure was developed to determine the productive rate of crews installing service lines. This method of determining the productive rate of a crew compensates for the different circumstances under which services are installed so that the productive rate for each crew is comparable. In addition, the standard productive rate is given so that the performance of each crew can also be compared with a standard.

In determining the productive rate, productive hours as reported on Illustration II by the crew foreman are used. Non-productive hours also recorded on Illustration II record the effectiveness of the organization serving the crew. These two records, when accumulated, direct the supervisors attention to crews which require his assistance and also to any weaknesses in the organization serving the crews. (See Illustration III)

The following are instructions for determining the productive rate and also describe how the graphs are derived.

Use of Graphs

Select the graph which represents the circumstances of installation as indicated by the crew foreman on Illustration II.

Read off the work units related to the length of the service.

Divide the work units thus obtained by the productive man hours to arrive at the productive rate. This data is entered on Illustration III.

Adjustments

For sticky clay soil, hand dug and hand backfilled, increase the work units obtained from the graph by 16%.

For sticky sandy soil, hand dug and hand backfilled, increase the work units obtained from the graph by 10%.

For sticky soil, ditcher dug but hand backfilled, increase the work units obtained from the graph by 14%.

The following data is provided to show how the graphs have been derived and to provide the information for unusual adjustments - e.g. a ditch partially hand dug with the balance machine dug, garage service in the same trench, etc.

The Basic Data - job elements of a service installation with standard time for each element in the case of a scattered 3/4" service, 80' long, hand dug in clay soil and backfilled by hand.

Job Elements

Standard Time In Work Units (man minutes)

Note: Moving time is not included in productive time.

(1) Make ready operations		50
Unload truck		
Get out and prepare tools		
Mark and measure House to Property		
Allowance for maintenance of tools		
(2) Fixed Operations		
Cap 1 length	5	
Start enamel pot	5	
Tests	25	
Measure pipe and record	10	
Hole in wall	60	
Prepare cement and oakum	5	
Tap main	10	
Bleed line, barrel lock, oakum		
and cement	10	
Stencil	5	
Measure for location	<u>10</u>	145

(3) Pipe Handling, treating and welding		
Align pipe	10	
Welding pipe	20	
Make up vent	5	
Make up Main to Property	10	
Weld T	10	
Wrap and enamel House to property	20	
Place pipe in trench	20	
Install M to P, riser, vent,		
service cock	20	
Prime M to P, T, H to P, and		
service cock	5	
Enamel M to P, T, and service		
cock	<u>15</u>	135
(4) Records and supervision		20
(5) Dig bell hole		100
(6) Dig trench		255
(7) Backfill		165
(8) Pack up for move		<u>10</u>
	Standard work units for	
	80' service	<u>880</u>

To arrive at graph, the work units for two other footages are required.

Thus, to adjust for 100 foot service:

Add 20 work units for additional welding, enamelling and pipe fitting 20

To adjust work units for additional footage

Work units applicable to digging trench	255
Work units applicable to backfilling trench	<u>125</u>
	380

$800 - 380 + (380 \times \frac{100}{80}) =$	<u>975</u>
Standard work units for 100' service	<u>995</u>

To adjust for 60 foot service

$800 - 380 + (380 \times \frac{60}{80})$	785
--	-----

Deduct 20 W.U.'s for less welding etc.	<u>20</u>
Standard work units for 60' service	<u>765</u>

Scattered 3/4" service, 80' long, hand dug, sandy soil,
backfilled by hand

Job Element	Standard Time
(1)	50
(2)	145
(3)	135
(4)	20
(5)	75
(6)	195
(7)	150
(8)	<u>10</u>

Standard work units for 80' service 780

NOTE: Based on sandy soil 25% easier to dig and 10% easier to backfill.

To adjust for 100 foot service

$$780 - 300 + (300 \times \frac{100}{80}) = 855$$

Add 20 W.U's for additional welding etc. 20 875

To adjust for 60 foot service

$$780 - 300 + (300 \times \frac{60}{80}) = 705$$

Deduct 20 W.U's for less welding etc. 20 685

More than one 3/4" service at the same site, dug and
backfilled by hand, clay soil

Job Element	Standard Time
(1)	20
(2)	140
(3)	120
(4)	20
(5)	100
(6)	255
(7)	165
(8)	<u>5</u>

Standard work units for 80' service 825

To adjust for 100 foot service

$$825 - 380 + (380 \times \frac{100}{80}) = 920$$

Add 20 W.U's for additional welding etc. 20 940

To adjust for 60 foot service

$$825 - 380 + (380 \times \frac{60}{80}) = 730$$

Deduct 20 W.U's for less welding etc. 20 710

More than one 3/4" service at the same site, dug and backfilled
by hand, sandy soil

Job Element	Standard Time
(1)	20
(2)	140
(3)	120
(4)	20
(5)	75
(6)	195
(7)	140
(8)	<u>5</u>

Standard work units for 80' service 715

To adjust for 100 foot service

$$715 - 300 + (300 \times \frac{100}{80}) = 790$$

Add 20 W.U's for additional welding etc. 20 810

To adjust for 60 foot service

$$715 - 300 + (300 \times \frac{60}{80}) = 640$$

Deduct 20 W.U's for less welding etc. 20 620

Scattered 3/4" service, ditcher dug and backfilled by hand,
clay soil

Job Element	Standard Time
(1)	45
(2)	155
(3)	135
(4)	20
(5)	100
(6)	20
(7)	125
(8)	<u>10</u>

Standard work units for 80' service 610

NOTE: Ditcher dug reduces ditch backfilling time by 25%.
Backfilling ditch is 75% of backfilling of an 80' service.

To adjust for 200 foot service

$$610 - 95 + (95 \times \frac{200}{80}) = 755$$

Allowance for additional walking	10	
welding	20	
aligning	10	
pipe in trench	20	
enamelling	<u>10</u>	825

To adjust for 300 foot service

$$610 - 95 + (95 \times \frac{300}{80}) = 875$$

Allowance for additional walking	15
welding	40
aligning	20
pipe in trench	30
enamelling	<u>20</u>

1000

Scattered 3/4" service, ditcher dug and backfilled
by hand, sandy soil

Job Element	Standard Time
(1)	45
(2)	155
(3)	135
(4)	20
(5)	75
(6)	20
(7)	115
(8)	<u>10</u>

Standard work units for 80' service 575

To adjust for 200 foot service

$$575 - 85 + (85 \times \frac{200}{80}) = 705$$

Allowance for additional walking	10
welding	20
aligning	10
pipe in trench	20
enamelling	<u>10</u>

775

To adjust for 300 foot service

$$575 - 85 + (85 \times \frac{300}{80}) = 810$$

Allowance for additional walking	15
welding	40
aligning	20
pipe in trench	30
enamelling	<u>20</u>

935

3/4" Services in a series - ditcher dug - backfilled by
hand - clay soil

Job Element	Standard Time
(1)	10
(2)	135
(3)	125
(4)	20
(5)	100
(6)	20
(7)	125
(8)	<u>5</u>

Standard work units for 80' service 540

To adjust for 100 foot service

$$540 - 125 + (125 \times \frac{100}{80}) = 570$$

Add 20 work units for additional welding etc. 20 590

To adjust for 60 foot service

$$540 - 125 + (125 \times \frac{60}{80}) = 510$$

Deduct 20 work units for less welding etc. 20 490

3/4" Services in a series - ditcher dug - backfilled
by hand - sandy soil

Job Element	Standard Time
(1)	10
(2)	135
(3)	125
(4)	20
(5)	75
(6)	20
(7)	115
(8)	<u>5</u>

Standard work units for 80' service 505

To adjust for 100 foot service

$$505 - 85 + (85 \times \frac{100}{80}) = 525$$

Add 20 work units for additional welding etc. 20 545

To adjust for 60 foot service

$$505 - 85 + (85 \times \frac{60}{80}) = 485$$

Deduct 20 work units for less welding etc. 20 465

3/4" Services in series - ditcher dug - backfilled
by machine

<u>Job Element</u>	<u>Standard Time</u>
(1)	10
(2)	135
(3)	125
(4)	20
(5)	100
(6)	20
(7)	15
(8)	<u>5</u>

Standard work units for 80' service 430

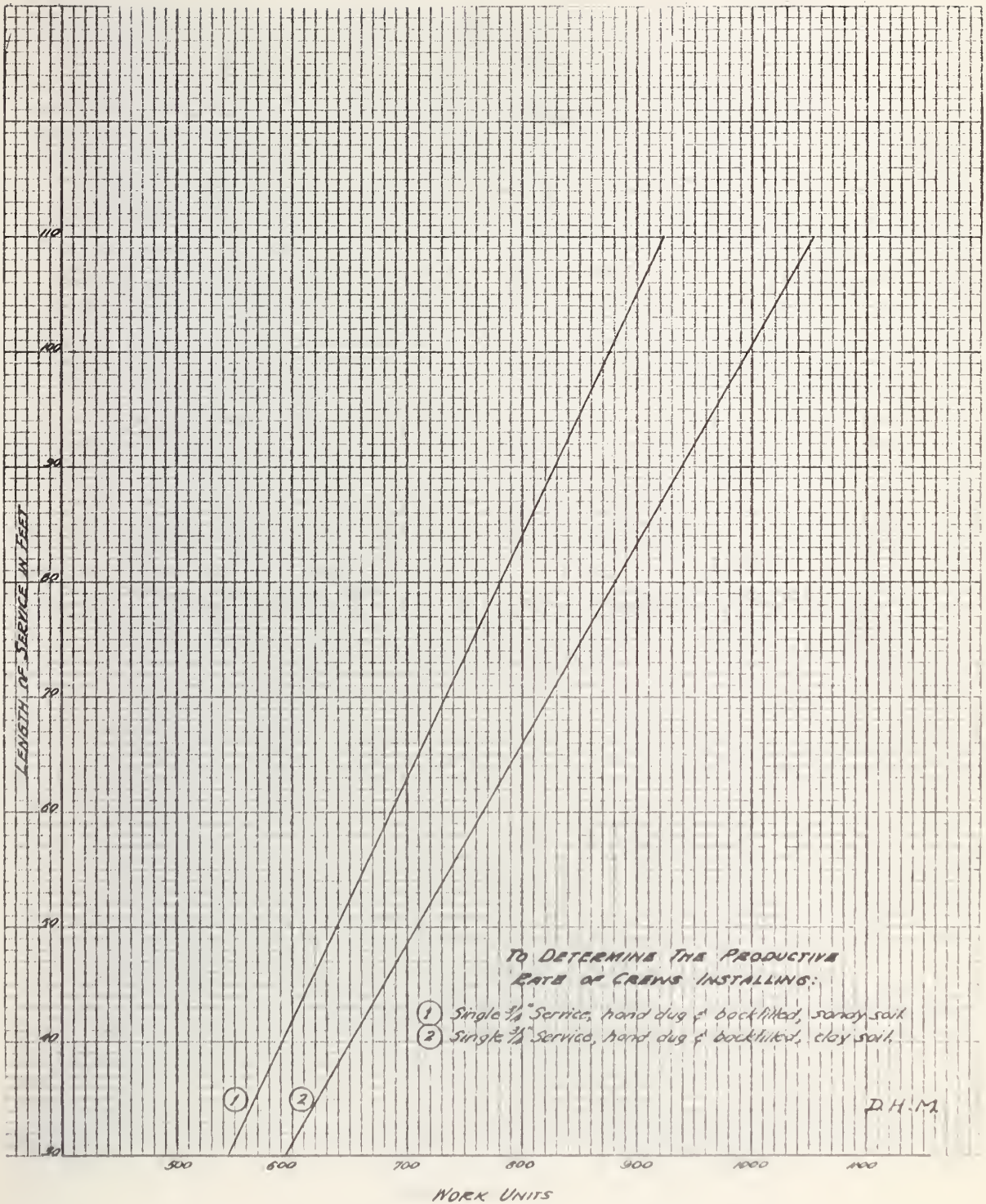
To adjust for 100 foot service

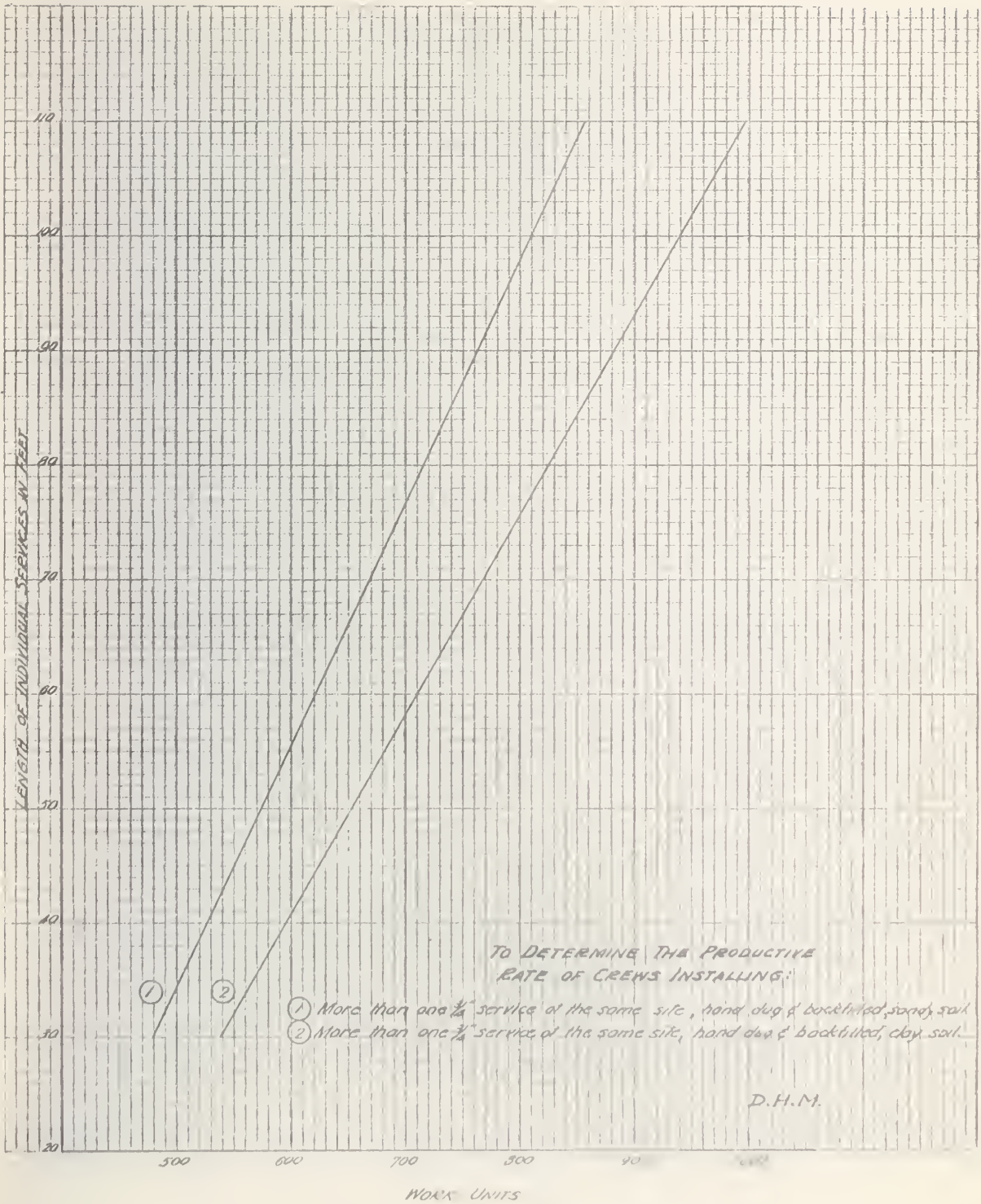
Add 20 work units for additional welding etc. 450

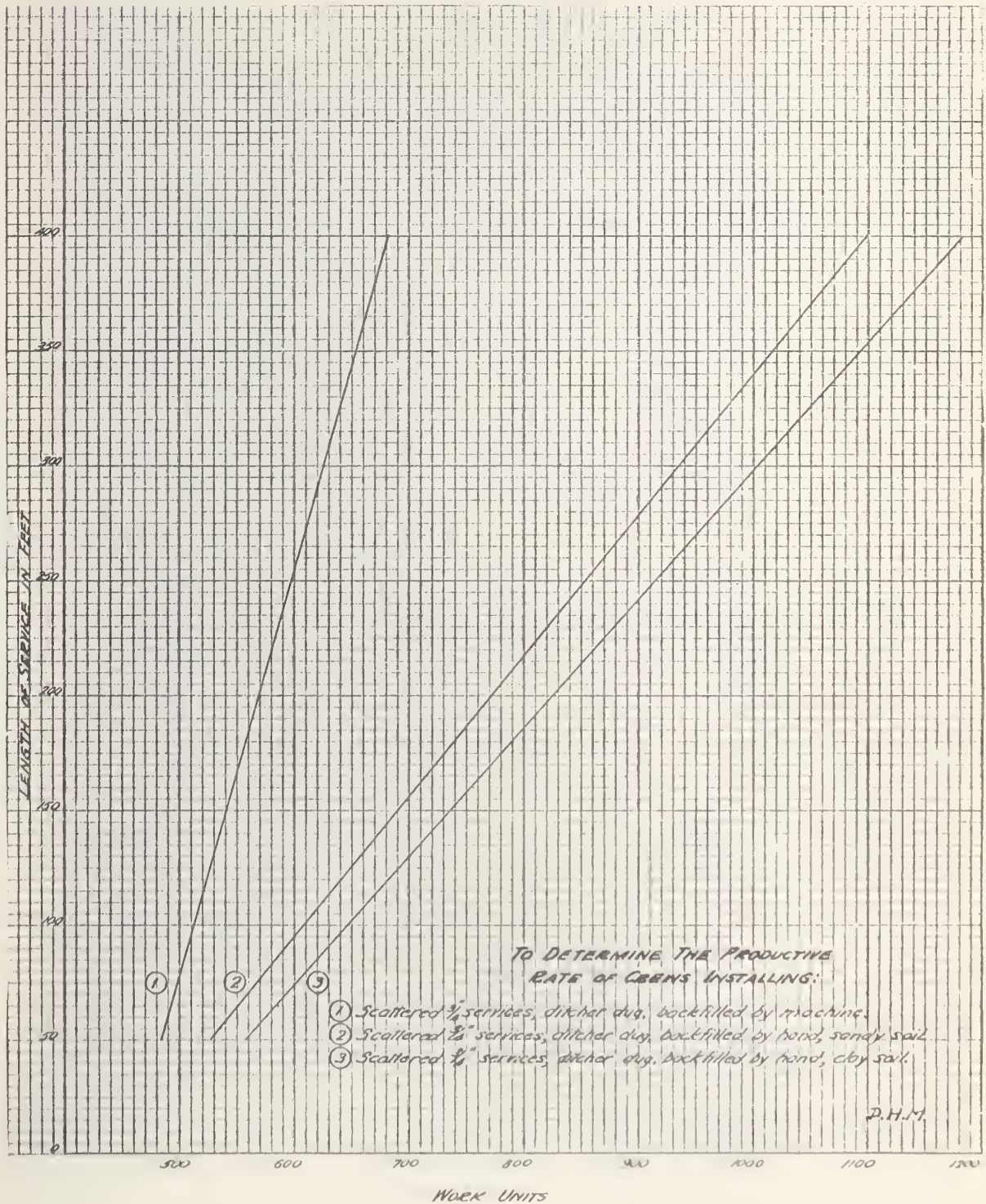
To adjust for 60 foot service

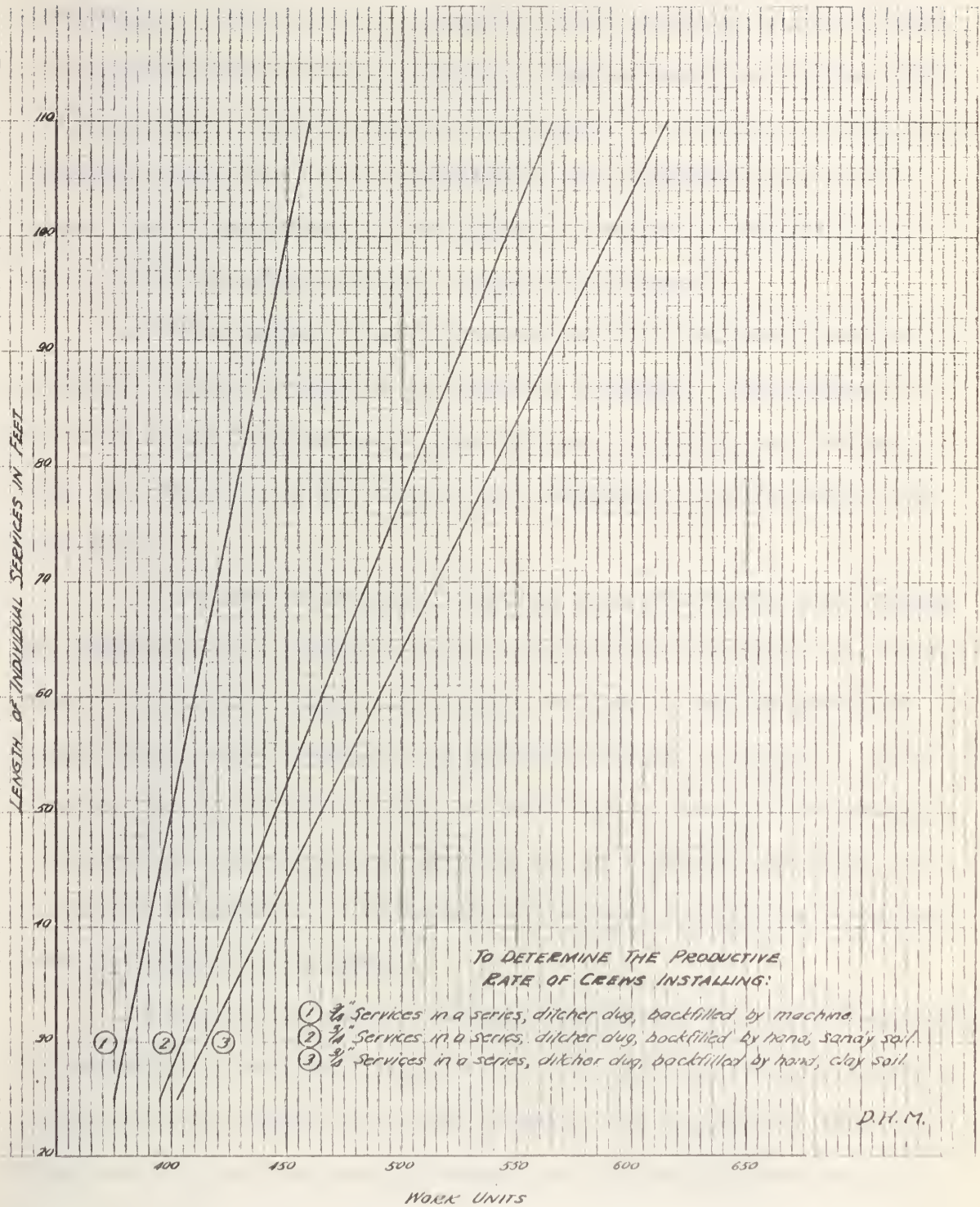
Deduct 20 work units for less welding etc. 410

NOTE: The time of machine operators is not included in the crews productive time.









5) The productive record of each crew foreman each day and accumulated to date is tabulated on Illustration III. In addition, the percentage of unproductive to productive hours measures the efficiency of the organization behind the crews. These accumulated records direct the supervisor's and the installation foreman's attention to crews which require guidance and to any weakening of the organization behind the crews. The effectiveness of the productive record is related to the use of it by the supervisor and installation foreman.

6) The activity chart Illustration I for scattered services is a guide for the most effective installation procedure. The progress of the work should be governed so that the tee, the ditch, the string of pipe, and the hole in the wall are all completed at approximately the same time.

In the case of services installed in a series, the crew foremen are instructed that a service crew consists of two sections, the skilled section which welds, pipe fits, enamels and tests, and the unskilled section which digs, backfills and punches the hole in the wall. This concept enables the crew foreman to guide the two phases of a series installation without one phase getting out of line with the other, thus minimizing standby time. Adjustment is provided by shifting personnel from one section to the other.

7) Due to the peak of installations during the late autumn caused by construction completions which is in turn governed by our climate, a relatively large number of skilled personnel are required at that time. These are obtained from our Maintenance and Inspection crews who have completed their annual program with the assistance of skilled service crew personnel, a number of whom would not otherwise be fully employed during the winter and early summer.

ILLUSTRATION I

SCATTERED SERVICES - HAND DUG

(Add 1 Digger For Hard Digging)

1 Foreman - welder pipe fitter
1 Pipe Fitter Enameller Digger
3 Diggers

Foreman

Pipe Fitter - Enameller

Digger

Digger

0:00 Mark Service for trenching &
:05 measure for H to P string
:10 Cap end of one length of pipe
Align Pipe
:20 Weld Pipe
:30 Put On Test
Make Up Riser and Vent
:40 Soap & take off test
:50 Make up M to P
1:00 Measure Pipe and Record
Mark and punch hole
:10 Carry riser and bent
and brace and bit
:20
:30 Weld
T
:40 Jeep
:50 Service Order
Pipe in trench & through wall
correct distance
2:00 Install riser and vent
:10 Test soap M to P and riser
:20 Watch tapping
Bleed line & put on barrel
lock; oakum & cement
:40 Stencil
Measure for location
:50 Service Order

Help work & measure
Start Enamel Pot
Help align pipe
Help weld pipe
Dig trench
Help measure pipe & prime
Help punch hole
Carry hammer and
chisels
Wrap & enamel H to P
Trench
Pipe in trench
Install M to P and service
cock & spindle
Prepare cement & oakum
Prime M to P
Tap
Enamel M to P, T and
service cock in same order
as priming
Help measure for location
Clean Up

Bellhole

Help
Bellhole

Trench

Pour Enamel

Trench

Pipe In Trench

Pipe In Trench

Backfill

Backfill

Backfill

Trench -
do next to
house first

Date 195

Check Number of Moves this day C,1,2,3,4.

UNIT LABOR COST SHEET

Weather

[illegible]

ways for the new

Give brief description of extraordinary circumstances

CHAPTER V

Participation Of Supervisors and Foremen In The Preparation Of The Operating and Maintenance Budgets

The operating and maintenance budget is prepared primarily for the scrutiny of, and authorization by top management of the proposed expenditures for the coming year. When the items are compiled chronologically and in sufficient detail the budget becomes a guide to supervisors and foremen directly responsible for carrying out the work and, when matched with their record of activity during the year, provides an excellent tool for management control. This assumes that the estimates are based on reasonable standards of performance.

The purpose of this chapter is to show how a budget is prepared so that supervisors and foremen record the work which their crews will complete during the year, chronologically arranged so that maximum use is made of their existing staff. The method of preparation also establishes the validity of any request for additions to staff, again assuming that the estimates themselves are based on reasonable standards of performance.

The objective approach to budgeting lists the jobs to be done together with an estimate of the time and material required for each job, followed by allocation of individual staff members to the jobs; rather than the procedure of listing the staff first and then fittings the jobs to the staff.

The instructions issued to the supervisors and foremen who are to participate in the preparation of the budget are as follows:

(1) All of the operating and maintenance jobs that are to be done in each district should be listed under their proper account number and chronologically by the months in which they are to start. See attached example (1). Refer to your 1955 Budget Details or ask for guidance regarding the account in which the job belongs.

It is important that each job to be done is listed individually regardless of its size in order that a complete record of all work to be done is available, and in order that your Department Head may appraise each item.

(2) The next step is to estimate the amount of labor required for each job in terms of man days and the cost of the supplies and expenses in terms of dollars. Include the names of the permanent men and the number of days each will spend on the job. The balance of the labor is additional labor.

An estimate should be prepared for each of the jobs listed as per paragraph (1) above. See attached example (2).

At this point we have listed all the operating and maintenance jobs which are to be done in the district during 1956. We also have the supporting data for each job which has been listed, consisting of the labor required for each job in terms of man days both permanent and temporary, and the cost of supplies and expenses in terms of dollars for each job.

(3) The next step is to re-arrange the time of the year when the jobs listed as per paragraph (1) will be carried out, to arrange for full employment of permanent staff.

In terms of units cost it is often cheaper to do a job during

the fall or summer months. But many jobs done during the most favourable weather conditions involve extensive use of additional labor, whereas permanent labor not fully employed may have been available during the early part of the year. Although the unit costs of the job done during the early part of the year may be higher, there will be a saving because of the use of permanent labor which would not otherwise be fully employed. On the other hand, if permanent labor is fully employed, it pays to do the job when the unit costs are lowest.

The re-arranging of the time of the year when jobs are to be done, or the re-arranging of the personnel to do the job, to budget for full employment of permanent staff can be accomplished as follows:

Prepare a sheet with the names of the permanent staff in the district along the top of the page and the jobs arranged by month and account along the left side from the list as prepared under paragraph (1). Also provide a column for additional labor along the right side. See example (3).

Under the name and opposite the job enter the number of days the permanent employee will be occupied with the job during the month. Also enter opposite the job in the additional labor column the number of additional labor man days estimated for the job. This information is obtained from the estimates prepared under paragraph (2).

In order to account for the twenty-two working days for each permanent employee each month, time spent on capital and annual vacations must be entered in the "Job" column.

The information thus compiled will reveal which members of the permanent staff in the district have been under-budgeted as to time and which members have been over-budgeted. The list of jobs (paragraph (1)) can now be re-arranged to correct this discrepancy and/or the names on the estimates changed.

(4) After the jobs listed as per paragraph (1) have been re-arranged, the permanent labor for each job in terms of man days can be entered in the Permanent Labor column of example (1). Also enter additional labor in terms of man days in the Additional Labor column. Also enter supplies and expenses in terms of dollars in the Supplies and Expenses column as obtained from the estimates, (Paragraph (2)). The information regarding permanent and additional labor for each job can be obtained from example (3)).

At this point the Budget Details of Operating and Maintenance for the district will be complete with the account number, the description of the job, the time when the job is to be done, the permanent labor in terms of man days, the additional labor in terms of man days and supplies and expenses in terms of dollars.

NOTES: (a) Assume that each month has 22 working days.

(b) "Miscellaneous" duties should be kept to a minimum.

(c) The cost of supplies and expenses for each job can be arrived at by the following methods.

1. Where unit costs from previous jobs are available, these should be used.
2. If unit costs are not available an itemized list of supplies and/or expenses should be prepared to arrive at the total of supplies and expenses for each job. This applies particularly to large jobs.
3. Certain supplies and expenses recur from year to year. Information concerning these can be obtained from the records.
4. Where none of the above methods are applicable, judgment will have to be used in estimating the cost. This applies particularly to small jobs.

There are a number of advantages in this method of preparing the operating and maintenance budget.

1) Participating supervisors and foremen advance their familiarity with thinking in terms of a full year's activity and how to arrange work to make the best use of their staff.

2) All the operating and maintenance activities are recorded by districts, which, when matched with work accomplished in the districts during the year, provides a tool of control.

3) Those who are responsible for carrying out the work in the various districts are the ones who have submitted the plans and estimates. Thus responsibility for results can be fixed.

4) Participation by all levels of supervision in the development of the budget fosters a more positive attitude to their work and a feeling of membership in management.

DETAILS OF ACCOUNTS

BUDGET 19 ____

DISTRICT _____

Account No.	Description	Months	Permanent Labor	Additional Labor	Supplies & Expenses
780	Portion of timekeeper's time	Jan.-Dec.	132 man days		
780 - 785	Walking transmission line (Include names of permanent personnel)	Jan.Feb.Mar. Apr.Nov.Dec.	264 man days		\$1,100
780 - 785	Misc. jobs operating transmission line (Support this item with detail)	Jan. - Dec.	132 man days	200 man days	400
780 - 785	Inject alcohol in farm service taps	Jan.Feb.Mar. Apr.Nov.Dec.	132 man days		200
780-785	Repair fences and gates	June & July	22 man days	22 man days	100
794	Repair leaks on transmission line	July	40 man days	30 man days	100
	etc.				

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EXAMPLE (2)

Work
Job Order No. _____
Account No. 780 - 785

Date: _____
Appropriation No. _____

*

WORK ESTIMATE FOR:

Install and remove snow fences

DETAIL	Hours Quantity	Rate Price	Perm. Labor	Add. Labor	Supp. & Expenses
Names of permanent employees					
Man A			4 days		
Man B			4 days		
1 Temporary				4 days	
Wire					\$15.00
Meals	12				15.00
Totals			8 days	4 days	\$30.00

SUMMARY: Estimated				Actual		
Labor	Perm.	Add.	Total	Perm.	Add.	Total
Supplies & Expenses						
Total Cost						

Budget Estimate: _____

See back of sheet for remarks

Budgeted Date: Oct. and May

Date of Completion: _____

EXAMPLE (3)

Man Days For Each Job Allocated
In Terms Of Time and Men

MONTH	ACCT.	DESCRIPTION	NAME				ADD'L LABOR
			Man A	Man B	Man C	Man D	
January	780	<u>District Transmission Jobs</u>					
		Portion of timekeeper's time	11				
		Walking lines		22	22		
	798	Inject alcohol in farm service taps etc.				11	
		<u>District Distribution Jobs</u>					
February	780	Portion of timekeeper's time	11				
		Inject alcohol in town regulator stations etc.				11	
		January Totals	22	22	22	22	
	798	<u>Transmission Jobs</u>					
		Portion of timekeeper's time	11				
March	780	Walking lines		22	22		
		Inject alcohol in farm service taps etc.				11	
		<u>Distribution Jobs</u>					
	798	Portion of timekeeper's time	11				
		Inject alcohol in town regulator stations etc.				11	
March		February Totals	22	22	22	22	
		etc.					

CHAPTER VI

CONCLUSION

The cost reduction programs described in this thesis vary in scope from the revision of an office procedure which directly affects comparatively few people, to the participation of supervisors and foremen in the preparation of the Operating and Maintenance Budget, an activity which affects the bulk of the work of the operating staff.

In the course of carrying out these studies, regardless of their scope, some basic differences between the outlook of line supervisors and staff people have become apparent. These differences, if not recognized, can cause misunderstandings between supervisors and analysts and hinder the implementation of the studies. Line supervisors emphasize the short run and naturally tend to give most of their attention to their individual department, whereas staff people look at operations in the longer run, and due to their training and nature of their work, tend to see the operations of a company as a whole. An example of an effort to overcome this difference in outlook occurs in Chapter V. Participation of line supervisors in the preparation of budgets is, in part, a campaign to familiarize them with thinking in terms of a full year's activity and to develop the concept that they are responsible for the most advantageous employment of each member of their staff throughout the year. In addition, the line supervisors are supplied with a copy of the entire budget which provides them with the opportunity of scrutinizing the other operations of the company.

Another basic difference between the outlook of line and staff people is the reasons which may be given to explain a high cost situation. The staff man's "why" may be excess labor cost, but such a reason is not the real explanation as seen by the supervisor. The supervisor wants to know why he

had excess labor cost. Chapter IV gets at the real reasons in the eyes of the supervisor why his labor costs were high and shows how to reduce the labor cost of installing services, which is what he wanted to know.

The detection of a high cost situation by an analyst implies a degree of failure on the part of the responsible supervisor. This is an unhappy situation, the effects of which can be attenuated by direct contact between the two men. When the supervisor is confident that he will get this consideration from staff personnel, that his embarrassment will not be broadcast up and down the hierarchy of staff and line, that he will get assistance in ferreting out the real reasons for high cost and that he will get assistance in finding out how to reduce his costs, then real understanding and co-operation can exist between the two parties.

Among the functions of the analyst, then, is the need to recognize the basic differences in outlook between line and staff personnel and to conduct his studies in a way which will develop co-operation and understanding. He must be adept at working with supervisors and workmen at all levels and patient in overcoming opposition to change. He must recognize that because of their multiplicity of duties and responsibilities, line supervisors cannot be expected to make thorough studies of the operations under their direction. For example, the stores supervisor could not find time to carry out the proposed study to improve materials handling as outlined in Chapter III. The analyst should assist in implementing new procedures but he must recognize that the responsibility for putting the improved methods into effect and for administering them rests with the line supervisor.

The analyst needs to be original in thought, somewhat ingenious in working out new ways of doing old jobs, practical in outlook and have an aptitude for analysis.

Finally, the analyst must clearly recognize the difference between the traditional and the analytical approach so that he will not be lured into the path of blindly following the path of past experience or the example of some other firm. This traditional approach may lead to difficulties because operating situations change sooner or later, or the action of the other firm, while desirable for them, may not fit every situation. However, past experience within the enterprise and the experience of other firms should be given careful consideration; but this information should be subjected to analysis and included with other evidence.

In sharp contrast to the traditional is the analytical approach. Preconceived ideas are set aside and new conclusions drawn from the data at hand. The problem is broken into its parts and each part examined. Out of the detailed examination of the facts new solutions will be found. The acceptance of the plan by the operating group is eased by their participation in its preparation and the demonstration to them that all angles were carefully considered. This approach is objective, analytical, creative and in some measure sells itself.

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